

ABSTRACT TO THE DISCLOSURE

High temperature fuel cell electrical generation systems are provided that are adapted to enable selective generation of electrical power, and/or hydrogen fuel, and/or useable heat, allowing flexible operation of the generation system. In such embodiments, the high temperature fuel cell may be either a MCFC or a SOFC. The disclosed systems relate to high temperature fuel cells exploiting gas separation devices in which a first gas mixture is to be separated so that a first product of the separation is enriched in a first component, while a second component is mixed with a displacement purge stream to form a second gas mixture, with provision to prevent cross contamination of purge gas components into the first product stream. The process may be applied to hydrogen (component A) enrichment from syngas mixtures such as fuel cell anode exhaust, where dilute carbon dioxide (component B) is to be rejected such as to the atmosphere or for recycle to the fuel cell cathode in the case of molten carbonate fuel cells, by purging with cathode exhaust oxygen-depleted air (as component C).